

## **REMARKS**

### **I. Introduction**

Claims 1 to 8 and 10 to 21 are pending in the present application. In view of the following remarks, it is respectfully submitted that all of the presently pending claims are allowable, and reconsideration is respectfully requested.

### **II. Rejection of Claims 1 to 3 Under 35 U.S.C. § 112, Second Paragraph**

Claims 1 to 3 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Although Applicants do not agree with the merits of this rejection, to facilitate prosecution, claim 1 has been amended herein without prejudice to recite: injecting a high-frequency power into the etching body via a substrate electrode; and refraining from injecting the high-frequency power into the etching body via the substrate electrode in response to an at least ambipolar plasma being present. Applicants respectfully submit that this amendment renders moot the present rejection. As such, withdrawal of this rejection is respectfully requested.

### **III. Rejection of Claims 1 to 8, 10, and 18 to 20 Under 35 U.S.C. § 103(a)**

Claims 1 to 8, 10, and 18 to 20 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of German Published Patent Application No. 199 57 169 ("Laermer et al.") and U.S. Patent No. 6,593,244 ("Wang et al."). It is respectfully submitted that the combination of Laermer et al. and Wang et al. does not render unpatentable the present claims for at least the following reasons.

As an initial matter, Applicants maintain that the machine-generated translation is replete with translation errors. Indeed, portions directly cited by the Examiner, e.g., page 4, paragraphs 4 and 5, contain grammatical translation errors to such an extent that the precise disclosure of these portions is unclear. Accordingly, an accurate English translation of Laermer et al. is again respectfully requested, as required pursuant to M.P.E.P. § 706.02 ("If the document is in a language other than English and the examiner seeks to rely on that document, a translation **must** be obtained so that the record is **clear** as to the **precise** facts the examiner is relying upon in support of the rejection." (Emphasis added)).

As another initial matter, and as indicated above, claim 1 has been amended herein without prejudice to recite: injecting a high-frequency power into the

etching body via a substrate electrode; and refraining from injecting the high-frequency power into the etching body via the substrate electrode in response to an at least ambipolar plasma being present.

Laermer et al. relate to a method for plasma etching with pulsed substrate electrode power. Nowhere do Laermer et al. disclose refraining from injecting a high-frequency power into the etching body via a substrate electrode whenever an at least approximately ambipolar plasma is present, as required by claim 1, or modulating the intensity of the plasma as a function of time, as required by independent claim 7. Nor do Laermer et al. disclose injecting a first pulse train into the etching body via a substrate electrode, injecting a second pulse train into the plasma for modulating a plasma intensity over time, wherein a fixed, integral phase ratio exists between the first pulse train and the second pulse train, as required by independent claim 4.

Other than generally stating that the plasma source produces a high-density plasma made of neutral radicals and electrically charged particles (ions), Laermer et al. simply do not discuss the plasma, let alone **when the plasma has reached an ambipolar state**, as required by independent claim 1, **modulating the intensity of the plasma** over time, as required by independent claim 7, or **establishing a relationship between power delivered to the plasma and power delivered to the etching body**, as required by independent claim 4. Nor do Laermer et al. state that the generator unit 30, used to produce the high-frequency-pulsed high-frequency power coupled into substrate electrode 12 and etching body 18, is controlled so as to assure that **power is not injected into the etching body via a substrate electrode whenever an at least approximately ambipolar plasma is present**, or is in any manner coordinated with a generator used to deliver power to the plasma.

Wang et al. do not cure the aforementioned deficiencies of Laermer et al. Specifically, Wang et al. do not disclose or suggest when or if the plasma has reached an ambipolar state, as required by claim 1, modulating the intensity of the plasma over time, as required by independent claim 7, or establishing a relationship between power delivered to the plasma and power delivered to the etching body, as required by independent claim 4. As further regards claim 1, the Office Action asserts at page 4 that "Laermer et al remain silent regarding etching is performed without substrate biasing, which **resemble** the claimed limitation of refraining from

injecting a high-frequency power into the etching body via a substrate electrode.” (Emphasis added). As such, it appears that the Office Action attempts to show that the proposed combination of Laermer et al. and Wang et al. would lead to features that **resemble** the features recited in claim 1. However, this is not a proper basis for establishing a *prima facie* case of obviousness. See, e.g., M.P.E.P. § 2141(III) (“The key to supporting any rejection under 35 U.S.C. § 103 is the clear articulation of the reason(s) why the **claimed** invention would have been obvious.” (Emphasis added).).

The Office Action states at page 3 that “Laermer et al. teach low frequency and high-frequency with respective pulse break (specifically page 4, paragraphs 4-5), which reads on the claimed limitation of refraining the high-frequency power at least approximately ambipolar plasma is present.” The Office Action further asserts at page 3 that “[a]s to the ambipolar plasma, it would have been obvious to include the plasma an ambipolar status because plasma is nothing but excited or reactive species (atoms, radicals and ions, which could be ambipolar in nature[]).” To the extent that these assertions are even understandable, Applicants note that the Office Action fails to present a valid *prima facie* case of obviousness for at least the reason that it does not provide any valid rationale, as it must under KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727, 82 U.S.P.Q.2d 1385 (2007), for the suggested modification or combination.

Even assuming, *arguendo*, that it would be obvious to utilize a plasma with an ambipolar state in the context of Laermer et al., Laermer et al. do not disclose, or even suggest, **refraining from injecting a high-frequency power into the etching body via a substrate electrode in response to an at least approximately ambipolar plasma being present.**

As regards the assertion at page 4 of the Office Action that “Wang teach the etching is performed with a pressure range of 77 millitorr to 100 torr (abstract), which leads to an ambipolar environment,” Applicants respectfully request that the Examiner provide specific evidence to establish this assertion under 37 C.F.R. § 1.104(d)(2) or otherwise. In particular, it is respectfully requested that the Examiner provide an affidavit and/or that the Examiner provide published information concerning this assertion. To the extent that the Examiner may be relying on inherency, the Examiner must provide a “basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows

from the teachings of the applied art.” (See M.P.E.P. § 2112; emphasis in original; and see Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Int’l. 1990)).

The Office Action at page 4 maintains reliance upon Figures 1a to 1c of Laermer et al., again asserting that Laermer et al. modulate the intensity of the plasma between a maximum and minimum value. However, as Applicants previously indicated in the “Response” filed on December 12, 2007, **Figures 1a to 1c show the power delivered to the substrate electrode 12 and/or etching body 18 – not the plasma**. See, e.g., machine translation of Laermer et al. at page 3, fourteenth para. (“In order to produce into the substrate electrode 12 and over it into the corroding body [i.e., etching body] 18 linked, high frequency pulsed the high frequency achievement, it is first intended that the high frequency generator 33 in the generator unit 30 prefers a high frequency carrier signal 54.”) (emphasis added) and Figures 1a to 1c (showing signal 54, which is included within pulses 52, which are included in pulses 50).

As indicated above, the combination of Laermer et al. and Wang et al. do not disclose, or even suggest, all of the features recited in any of claims 1, 4, and 7. As such, the combination of Laermer et al. and Wang et al. does not render unpatentable any of claims 1, 4, and 7.

As for claims 2, 3, and 18 to 20, which ultimately depend from claim 1 and therefore include all of the features of claim 1, and claims 5 and 6, which ultimately depend from claim 4 and therefore include all of the features of claim 4, and claims 8 and 10, which depend from claim 7 and therefore include all of the features of claim 7, is respectfully submitted that the combination of Laermer et al. and Wang et al. does not render unpatentable these dependent claims for at least the same reasons given above.

In view of all of the foregoing, withdrawal of this rejection is respectfully requested.

#### **IV. Rejection of Claims 11 to 15 Under 35 U.S.C. § 103(a)**

Claims 11 to 15 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Laermer et al., Wang et al., and U.S. Patent No. 5,290,383 (“Koshimizu”). Applicants respectfully submit that the combination of Laermer et al., Wang et al., and Koshimizu does not render unpatentable claims 11 to 15 for at least the following reasons.

Laermer et al. relate to a method for plasma etching with pulsed substrate electrode power. Wang et al. relate to a process for etching conductors at high etch rates. Koshimizu relate to a plasma-process system with an improved end-point detecting scheme. Nowhere does the combination of Laermer et al., Wang et al., and Koshimizu disclose, or even suggest, **at least at one time at which an at least approximately ambipolar plasma is present**, adding to the plasma an inert gas that is at least one of light and easily ionizable, as required by independent claim 11. The Office Action continues to refer to col. 14, lines 29 to 41, where Koshimizu states that certain gases are introduced into the etching chamber prior to application of power to the electrodes 106 and 108. However, as Applicants previously set forth in the "Response" dated December 12, 2007, Koshimizu does not state that these gases are introduced at a time when at least approximately ambipolar plasma is present in the chamber. On the contrary, in Koshimizu the gases are introduced even before generation of the plasma in the chamber. See col. 14, lines 43 to 47.

As indicated above, the combination of Laermer et al., Wang et al., and Koshimizu does not disclose, or even suggest, all of the features of independent claim 11. As such, it is respectfully submitted that the combination of Laermer et al., Wang et al., and Koshimizu does not render unpatentable claim 11.

Claims 12 to 15 ultimately depend from claim 11 and therefore include all of the features recited in claim 11. As such, it is respectfully submitted that the combination of Laermer et al., Wang et al., and Koshimizu does not render unpatentable these dependent claims for at least the same reasons set forth above in support of the patentability of claim 11.

In view of all of the foregoing, withdrawal of this rejection is respectfully requested.

#### **V. Rejection of Claims 16 and 17 Under 35 U.S.C. § 103(a)**

Claims 16 and 17 were rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Laermer et al., Wang et al., and U.S. Patent No. 5,779,925 ("Hashimoto et al."). Applicants respectfully submit that the combination of Laermer et al., Wang et al., and Hashimoto et al. does not render unpatentable claims 16 and 17 for at least the following reasons.

Hashimoto et al. purportedly relate to plasma processing with less damage. The Office Action alleges that Hashimoto et al. disclose that the RF bias is synchronized with the on/off modulation in order to reduce charging damage without lowering the throughput. However, nowhere does the combination of Laermer et al., Wang et al., and Hashimoto et al. disclose, or even suggest, the specific relationship between the plasma pulse frequency and the power injected into the etching body required by independent claim 16, *i.e.*, setting as a plasma pulse frequency an odd-numbered multiple of a frequency of a low-frequency modulation of a high-frequency power injected into the etching body via a substrate electrode, and synchronizing the first modulation and the low-frequency modulation with one another so that  $n$  plasma pulses ( $n = 1, 2, 3, \dots$ ) fall in each pulse injected into the etching body using the substrate electrode while  $n + 1$  plasma pulses occur during a pause in an energy injection into the etching body.

As indicated above, the combination of Laermer et al., Wang et al., and Hashimoto et al. does not disclose, or even suggest, all of the features recited in claim 16. As such, the combination of Laermer et al., Wang et al., and Hashimoto do not render unpatentable independent claim 16.

Claim 17 depends from claim 16 and therefore includes all of the features recited in claim 16. As such, it is respectfully submitted that the combination of Laermer et al., Wang et al., and Hashimoto does not render unpatentable claim 17 for at least the same reasons set forth above in support of the patentability of claim 16.

In view of all of the foregoing, withdrawal of this rejection is respectfully requested.

#### **VI. Rejection of Claim 21 Under 35 U.S.C. § 103(a)**

Claim 21 was rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Laermer et al., Wang et al., and U.S. Patent No. 4,799,991 ("Dockrey"). Applicants respectfully submit that the combination of Laermer et al., Wang et al., and Dockrey does not render unpatentable claim 21 for at least the same reasons submitted above in support of the patentability of claim 1, from which claim 21 depends. Specifically, Applicants respectfully submit that the combination of Laermer et al., Wang et al., and Dockrey does not disclose, or even suggest, **refraining from injecting a high-frequency power into the etching body via a**

**substrate electrode in response to an at least approximately ambipolar plasma being present**, as required by claim 1. Dockrey purportedly relates to a process for differentially etching polycrystalline silicon. Dockrey does not remedy the above-noted deficiencies of the combination of Laermer et al. and Wang et al. Nor is Dockrey relied upon for remedying the above-noted deficiencies of Laermer et al. and Wang et al. Therefore, withdrawal of the present rejection is respectfully requested.

## **VII. Conclusion**

It is therefore respectfully submitted that all of the presently pending claims are allowable. All issues raised by the Examiner having been addressed, an early and favorable action on the merits is earnestly solicited.

Respectfully submitted,

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